MAT 201 Math for Elementary Teachers I
Number, Operations and Numerical Systems

Credit Hours: **3**
Effective Term: **Fall 2015**
SUN#: **NA**
AGEC: **Mathematics**

Credit Breakdown: **3 Lectures**
Times for Credit: **1**
Grading Option: **A/F Only**
Cross-Listed: **None**

Description: An explanation of numbers, number systems, operations on numbers, and problem solving. The course is designed to meet the requirements for prospective elementary education teachers.

Prerequisites: MAT141 or MAT151

Corequisites: None

Measurable Student Learning Outcomes

1. (Application Level) Apply basic set theory, patterns and inductive/deductive reasoning to solve problems.

Example 1:

A turtle is at the bottom of a 13 foot well. Each day it crawls up 5 feet, but each night it slips back 4 feet. After how many days will the turtle reach the top of the well?

Example 2:

Use deductive reasoning to show that if n is a multiple of 2, then n^2 is a multiple of 4. (Note: A multiple of k is a number of the form ks, where s is a whole number.)

2. (Application Level) Solve problems from a variety of contexts using a variety of strategies including technology.

Example 1:

There is a certain order in which operations must be performed when evaluating expressions. Type the **single calculation** (in other works, I only want to hit enter(=) once) using the numbers below to get the target number of 7. You must use all the numbers only once, but you can use the operations of $\times, \div, +, -$ and parentheses as many times as needed.

a) 1, 2, 4, 5, 6
b) 2, 11, 15, 17, 24

3. (Application Level) Perform operations in non-base ten systems.

Example 1:

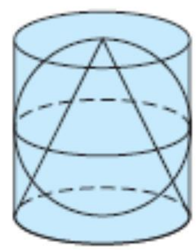
Multiply the given numbers in the indicated base: $312_{five} \times 42_{five}$

Example 2:

Subtract the given numbers in the indicated base: $300_{five} - 42_{five}$

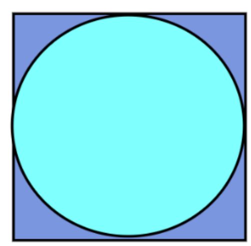
4. (Application Level) Solve problems of area, perimeter, volume, ratios and percent.

Example 1:



The right circular cylinder and cone shown in the accompanying figure both have a base of radius r and height 2r, and the sphere has radius r. Show that the ratio of the volumes of the cone to the sphere to the cylinder is 1 to 2 to 3.

Example 2:



A circle is inscribed in a square, as in the picture shown.

(a) What percentage of the area of the square is inside the circle?

(b) If the radius of the circle is 11 cm, what is the perimeter of the region formed by removing the area inside the circle from the square?

5. (Application Level) State, illustrate and apply number properties.

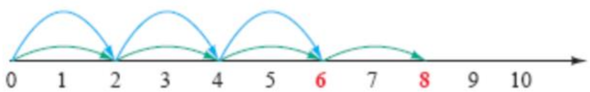
Example 1:

The GCD (or GCF) of three natural numbers can be computed by replacing any number with the difference it makes with any smaller number. If two (or more) numbers are the same, all but one can be discarded. The last positive number remaining is the GCF, since

GCF(a)=a for any natural number a. Use the pairwise difference method to compute these GCDs and GCFs.

Example 2:

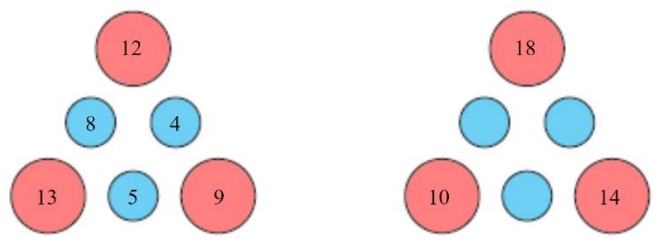
Indicate how you could use a number line to illustrate the notion of the greatest common divisor and least common multiple to children.



6. (Analysis Level) Analyze number patterns to solve problems and extend number patterns to algebraic reasoning.

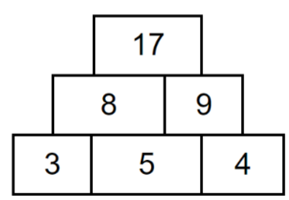
Example 1:

In the circle patterns to the right, each number in a large circle is the sum of the numbers in the two adjacent small circles. The pattern on the left is complete, but the pattern on the right needs to be completed. Do so by letting x denote the value in one of the small circles. Now obtain expressions and equations that let you solve for x and determine the values in all three small circles.

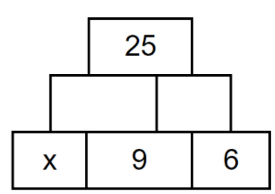


Example 2:

The figure to the right shows an addition pyramid, in which each number is the sum of the two numbers immediately below. For each of the incomplete addition pyramids, show that the values in each square can be determined by forming and solving an equation in the unknown variable shown. Complete parts a through c below.



a) In terms of x, what is the value of the first entry in the second row of the addition pyramid to the right?
b) What is the value of the second entry in the second row?
c) Use these values to write an equation. Choose the correct equation below.
   i. $(x + 9) + 6 = 25$
   ii. $(x + 9) + 15 = 25$



iii. $6 + 25 = x$

iv. $15 + 25 = x + 6$

7. (Application Level) Apply number systems to solve problems.

Example 1:

A light-year is the distance light travels in empty space in one year.

(a) Light travels at a speed of 186,000 miles per second. The star nearest the sun is Proxima Centauri, in the constellation Centaurus, whose distance from Earth is 4 light years. What is the distance to Proxima Centauri in miles?

(b) In metric measurements, the speed of light is 3.00×10^8 meters per second. Verify that a light-year is about 10^{16} meters.

8. (Application Level) Apply various mental and concrete models for addition, subtraction, multiplication and division operations.

Example 1:

Suppose you have 4 mats, 25 strips, and 19 units for a total count of 669. Briefly describe the exchanges you would make to keep the same total count but have the smallest possible number of manipulative pieces.

Example 2:

Use the Egyptian algorithm to calculate the product 7×18. Note: To use the Egyptian algorithm, first rewrite the number 7 as a sum of powers of two.

9. (Analysis Level) Analyze interconnections among mathematical operations.

Example 1:

Multiply 25×17 using an array and then using that array to show the distributive property of (20+5)(10+7).

10. (Application Level) Apply algebra concepts and processes including the real number system and proportional reasoning.

Example 1:

The Green Cab Company charges $3.75 plus $0.35 per quarter mile traveled. The Red Taxi Company charges $3.15 plus $0.45 per quarter mile. Apparently, you should take a Red Taxi for short trips and a Green Cab for longer trips. Use proportional reasoning to determine the break-even distance.

Example 2:

One day a teacher took his class of sixth graders outside and challenged them to find the distance between two rocks that could easily be seen, one above the other, on the vertical face of a bluff near the school. After some discussion, the children decided to hold a rod in a vertical position at a point 105 ' from the base of the cliff, as shown in the accompanying figure. They also decided to mark the points on the rod where the lines of sight of a student standing 2 ' farther from the cliff and looking at the rocks cut the rod. If the marks on the rod were 22 '' apart, what was the distance between the two rocks?